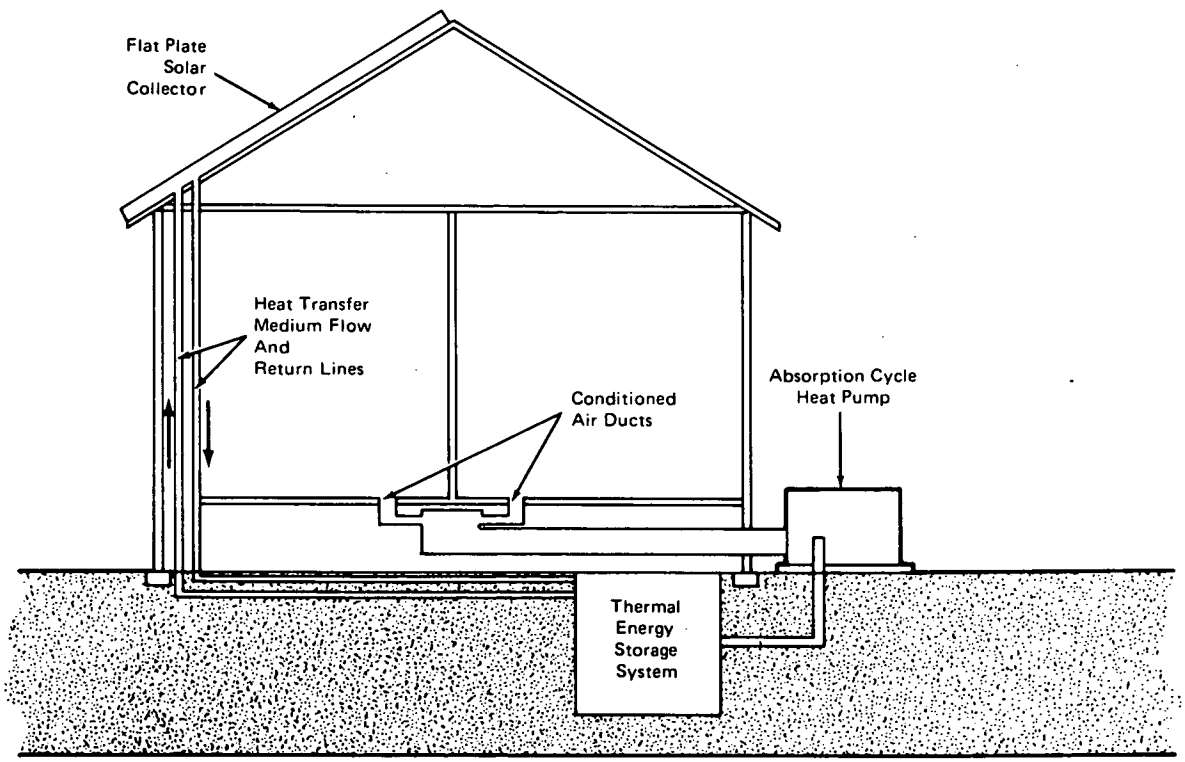
NASA TECH BRIEF

Marshall Space Flight Center

A Practical Solar Energy Heating and Cooling System



Schematic of Solar-Powered Space Heating, Air-Conditioning and Hot Water Heating System

A recent study has concluded that a solar-powered residential heating and cooling system is now technically and economically feasible. The proposed system provides space heating, air conditioning, and hot water. The illustration shows how the system could be used in a typical home. The major components are:

(a) a flat-plate solar collector to process solar radiation,

(b) a thermal-energy storage system to store the collected energy for use during night and heavily overcast periods.

(c) an absorption cycle heat pump for both heating and cooling the residence, and

(d) a hot water system (not shown) that uses heat from the energy storage system.

The best solar collector was predicted to consist of two transparent covers over an aluminum thermal absorber plate treated with a special selective coating. The orientation of the collector can be optimized for a particular geographic location. The heat is transferred to a fluid that carries it to the energy storage system.

(continued overleaf)

The energy transfer fluid and the energy storage fluid may be water or a phase-change material. Economic and technical analyses of candidate fluids indicate that water is the best choice for the energy storage substance. In the system it is stored in an insulated, slightly pressurized container.

An ammonia and water mixture is the most efficient heat pump working fluid. Using this mixture no serious problems are envisioned in the design and fabrication of a heat pump, since the required pump will be similar to commercial units.

As part of the study, mathematical models have been constructed for the analysis and evaluation of all phases of the system. Both technical and economic criteria have been considered in the selection of an optimal system from among several alternatives.

The system should be usable in all parts of the United States. The costs of installation will be greater than for conventional heating systems, but this differential will be defrayed after a few years of service by the very low operating costs. In fact, in the long run, solar-energy heating and cooling will be less expensive than present methods.

Notes:

1. This study was a feasibility project, and an actual working model has not yet been tested. However, plans are underway for the construction and testing of prototypes.
2. Requests for further information may be directed to:
   Technology Utilization Office
   Marshall Space Flight Center
   Code A&PS-TU
   Marshall Space Flight Center, Alabama 35812
   Reference: B73-10156

Patent status:

NASA has decided not to apply for a patent.

Source: M. J. O'Neill, A. J. McDanal,
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